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Isidore's father and later his antagonist, almost always referred to Étienne Geoffroy St. Hilaire as "M. Geoffroy." In bibliographies and catalogues the respective names are to be found under Barthélemy and Geoffroy.

These are certainly very few and really unimportant blemishes to a work of such general excellence. Before the appearance of the volume, the English-reading peoples were far behind the French and Germans in versions of the "History of Animals." Now we are ahead of all and it will probably be long before it can be superseded by another. Before such shall be the case, the fauna of Greece must be thoroughly explored and doubtless in some sheltered nooks names of animals that have perished in places investigated may be still found in use as in Aristotle's time but under variant modifications. Meanwhile, we shall have reason to congratulate ourselves on the superiority of that which we have.

THEO. GILL

NOTES ON METEOROLOGY AND CLIMATOLOGY

THOUGH authorities agree that climate is practically unchangeable, except when geological time-units are considered, this problem, and especially the corollary relating to mild winters and severe springs, has aroused considerable discussion. The backwardness of spring during the last few years in many parts of the United States has caused considerable alarm among those who are directly affected. In Missouri orchardists have begun to question the policy of continuing the attempt to raise fruit on an extensive commercial scale. In view of these facts, Mr. George Reeder, section director of the United States Weather Bureau, made a study of the cause of the alarm. His investigation has been summarized in a paper, "Late Spring Frosts in Relation to the Fruit Crop of Missouri," which was read at the January meeting of the Missouri State Horticultural Society. It is reprinted in part in the *Monthly Weather Review* for December, 1910. He points out the fact that the daily minimum temperature, rather than the mean temperature for the day, is the important factor, for it is the extreme minimum rather than the mean daily temperature that affects vegetation most. As far as minimum temperatures are concerned, the springs of the last ten years, and particularly the last five years, averaged colder than those of the preceding fifteen years. Not only is the average of the daily minimum temperatures for April and May lower in the last decade than in the preceding two decades, but the frequency of freezing temperatures during these months has been greater of late than formerly. While this is an apparent substantiation of the popular notion that "our climate has changed," he cautions the reader from drawing such a conclusion, suggesting that these changes occur in cycles or oscillations. Data for a sufficiently long period are not available for determining the lengths of these cycles, or for forecasting a change in the present conditions. In conclusion he says, "The popular idea that the climate is changing is evidently an old one, and is caused by the temperature and precipitation conditions remaining for comparatively short periods below or above the normal conditions; such changes should be referred to as oscillations in the weather rather than as changes in the climate."

"The Practical Application of Meteorology to Aeronautics," a paper which was read by the author, Mr. W. H. Dines, before the Aeronautical Society of Great Britain, appears in the *Aeronautical Journal* for January. He showed that the density, the temperature and especially the motion of the atmosphere are of considerable importance to the aviator. The decrease in density of the air with height results in a loss in supporting power, but since the actual resistance to forward motion becomes less, greater speed is possible. The decrease of temperature with height renders it necessary for the aviator to wear thicker and therefore heavier clothing. However, by far the most important consideration in this connection is the wind, both in respect to velocity and to direction. Wind affects aviation in two ways, (1) by its actual presence, and (2) by its steadiness or gustiness. From data obtained by means of kites and balloons, certain

principles have been recognized. For example, if one knows the barometric gradient at the ground he can compute approximately the velocity of the wind for moderate heights with the aid of Ferrel's formula and the known rate of increase of velocity with height. Moreover, the change of wind direction with height can be foretold when one's position with respect to the barometric distribution is known. Such information is of value both to the aeronaut, who in the free balloon seeks a desirable current by ascending or by descending, and to the aviator, who in an aeroplane can travel more advantageously with the wind than against it. In the opinion of Mr. Dines, progress in the art of mechanical flight depends largely upon meeting and overcoming the difficulty of the gustiness of the wind. Many accidents have had their origin in this condition, which is always present in a more or less degree. When it is serious enough to render flying hazardous the professional aviator aptly says that the air is "full of holes." In various ways it has been determined that the wind becomes steadier with increasing height, except within the stratum of fracto-cumulus clouds, when they are present. Increased speed does not result in increased stability unless the construction of the aeroplane is proportionately strengthened. These, and other facts based upon the meteorological data of Blue Hill Observatory are shown graphically, as well as verbally, in a book called "Charts of the Atmosphere for Aeronauts and Aviators," which is now in the hands of the publisher, John Wiley and Son, of New York.

A TEMPERATURE model, the second of its kind,[1] has recently been completed by Mr. Eugene Van Cleef, of Chicago. Based upon the data for the period 1890 to 1910, inclusive, it shows in relief the average hourly temperatures for that city. Of plaster-of-paris construction, it is two feet long and one foot wide. Vertical lines at inch intervals are drawn upon the two narrow sides to represent the months of the year, while similar lines drawn upon the other two sides represent the twenty-four hours of the day. The vertical dimension of each point upon the upper surface of the model represents temperature, each sixteenth of an inch representing one degree, the base being zero degrees Fahrenheit. The upper surface is anticlinal, and is colored to show the four seasons of the year. The model is instructive in many ways, the more striking features shown consisting of (1) the diurnal periodicity of temperature, (2) the change in the occurrence of the daily minimum temperature from about 6 A.M. during winter to 4:30 A.M. in summer, (3) the change in the occurrence of the maximum temperature of the day from about 3 P.M. in winter to about 1 P.M. in summer, and (4) the more rapid increase of temperature from spring to summer than the decrease from autumn to winter.

[1] See SCIENCE, Vol. XXXI., No. 807, p. 954.

IN the neglected field of phenological climatology a noteworthy contribution has been made by Dr. E. Vanderlinden in his "Étude sur les phénomènes Périodiques de la Végétation dans leurs Rapports avec la Variations climatiques." The latter describes the results of a study of the relation between climate and the flowering-date of thirty-nine plants, as observed at the Royal Observatory gardens in the suburbs of Brussels, during the fourteen years, 1896 to 1909, inclusive. Though the observer was the same throughout the period, all of the plants were not observed each year. The first appearance of the stamens was taken as a basis, since leaves and seeds develop irregularly. When possible, artificial conditions were produced to verify conclusions based upon the observations of the effects of similar natural conditions. The effect upon the flowering date of a plant by departures from the mean of the various meteorological elements affecting its growth was the real object of the study. Rainfall and atmospheric humidity had less effect in this respect than is generally supposed to be the case. Radiation, too, especially during the spring months, is comparatively unimportant. By far the most effective factor in determining the time of florescence is the temperature, though its importance varies with the different stages of the plant's life. Varieties accustomed to mature at about the same time are affected

similarly by departures in the average weather conditions. Though the approximate date of flowering is determined by heredity, the weather conditions of the preceding season, when the seeds are maturing, have no effect. When the flowering stage is delayed because of unfavorable conditions, a change to more favorable weather will bring out the flowers with a less amount of "accumulated temperature" than otherwise. In general, Dr. Vanderlinden concludes that temperature and insolation outweigh all other climatic factors in the development of the plant up to florescence.

HAVING been successful in the recovery of sounding-balloons previously sent up at Omaha, Neb., the United States Weather Bureau again used this station as a base of operations in a series of daily ascensions from February 7 to March 3. As it is necessary to recover the instrument carried by this form of balloon in order to get the desired record, the starting point must be well inland, as the prevailing wind aloft invariably blows the balloons eastward. At Mount Weather Observatory, which is unsuitably located for this particular work, pilot balloons have been used since March 1 to supplement the kite flights on the days set apart for international cooperation in aerological exploration. No attempt is made to recover these balloons, as they carry no instruments. By observing them with transit-instruments until they disappear, the velocity and the direction of the wind are obtained. They have been used successfully for this purpose at Blue Hill Observatory since 1909.

THOUGH it has generally been supposed that the rain gauge was invented by Castelli in the early part of the seventeenth century, recent discoveries seem to indicate that it was in use in Korea at a much earlier date. In Volume I. of the "Scientific Memoirs of the Korean Meteorological Observatory," Dr. Y. Wada, the director of the newly established weather service of that country, states that in 1442 King Sejo had a cylindrical bronze gauge, about 12 inches high and 5 inches in diameter, in which the depth of the water was measured after each occurrence of precipitation. In one which he has found, the cylinder stood in a depression in a boulder upon the sides of which an inscription gave the year and stated the purpose of the gauge. Though similar instruments were later used in other parts of the same country, Dr. Wada has been unable to recover any of the records, which were doubtless preserved for a time. The latter would be exceedingly interesting and valuable at present in furnishing data concerning climatic changes. Korea is a land of deficient rainfall now, and the special efforts made to measure it five centuries ago would seem to indicate that it was an important factor in the welfare of the people even at that early date, suggesting similar conditions then.

"Dynamic Meteorology and Hydrography," by Professor V. Bjerknes, of the University of Christiania, and various collaborators, has recently been publshed by the Carnegie Institution of Washington. The greater part of the volume consists of exhaustive discussions, in nine chapters, of the more important problems in statics. Diagrams, tables and mathematical demonstrations are generously employed to make clear some of the complex problems treated. The remainder of the book consists of hydrographic and meteorological tables. On account of the abstruse nature of the matters discussed, not many will appreciate the value of the work, but advanced students will doubtless find it a notable contribution.

Two interesting discussions of the cold of winter anticyclones are found in *Symons's Meteorological Magazine*. In the March number Mr. W. H. Dines states that according to the Greenwich records for the fifty years, 1841 to 1890, inclusive, a considerably larger number of days of frost occurred when the mean barometric pressure was below 29.80 inches than when it was above 30.20 inches. During that period nearly every frost noted for severity or length occurred in the low pressure series. The statement concerning the supposed cold in winter anticyclones in many text-books he says is not substantiated by evidence, and he suggests that the idea "may

have come from the mistaken notion that an anticyclone brought down air from the upper strata, and therefore ought to be cold. The descending air does occur, but the temperature during an anticyclone a few hundred feet high is unduly warm." In the April number Dr. J. Hann points out the fact that it is not the absolute height of the barometer that is determinative in locating anticyclones, but rather the relative height of the barometer compared with that of the surrounding districts. He maintains that the center of an anticyclonic area is cold in winter, "a focus of cold"—an opinion supported by the investigations of Hildebrandsson on temperatures in cyclones and anticyclones. "The cold arises in winter in anticyclonic regions as a result of radiation favored, in a high degree, by the clear skies and the dry air of the anticyclonic center. One can say definitely that the cooling of the earth in the winter half-year is accomplished mainly in the anticyclonic areas of the land surface. Nocturnal radiation is very intense in the dry air, especially when the surface of the ground is covered with snow." The extremes of the winter months in central Europe show no constant relation to the variations of pressure in central Europe itself, as the "focus of cold" is usually at the center of a persistent continental anticyclone to the northeast. Only in exceptional cases is central Europe itself the seat of this center, and when it is, abnormally cold weather is experienced. As the British Isles usually remain on the western side of the European anticyclone, and thus have southerly and southeasterly winds with high barometer, it follows that high temperatures quite often accompany the high barometer. At the same time, however, it is cold on the continent in the center of the European anticyclone.

ANDREW H. PALMER
BLUE HILL OBSERVATORY,
April 25, 1911

THE SOIL, A LIVING THING

FOR many years the fertility of the soil was sought in the chemical substances which analysis proved to be essential to plants and which could be exhausted from the soil by the continual growth of a single crop upon it. To restore the fertility of the soil, it was necessary only to restore the ingredients necessary to keep a plant in a productive condition. Fertilizers were applied which were known to contain the most important materials of plant food and in an available form. Even to-day, there are opposing camps of plant physiologists. One set holds to the principles, first clearly enunciated by Liebig, that the chemical condition of the soil is the most influential factor in the productivity of the garden, or farm. The other group consider that the physical condition of the soil influences the tilth. This school teaches that all agricultural soils contain sufficient quantities of the essential mineral plant foods for many years to come. Recently a more advanced position has been taken by some students of the soil, when they claim that the loss of fertility of many long cropped soils is due to the accumulation of toxic bodies, the accumulated excreta of plants that may have been grown without proper rotation. The true theory of soil fertility will probably be found to be one which will combine all of these theories with another one, which I believe must also be considered in reaching a satisfactory conclusion as to the relation existing between crops and the soil in which they grow.

The theory is one which considers that the soil is a living thing apart from its chemical or physical structure, that in the reaction between the living soil and the growing plant is the true explanation of soil fertility. A fertile soil is a live one. An infertile soil is a dead one. Contrast the soil which is filled with organic matter (humus) and in which numberless fungous, bacterial and protozoan organisms are at work with a mass of clay or sand without such organic material and associated living organisms. The one soil is fertile, because the organisms in the soil react favorably upon each other, the other soil is infertile, because the organisms present in this soil are antagonistic. Recent investiga-